Solar Power Modified Air Cooler

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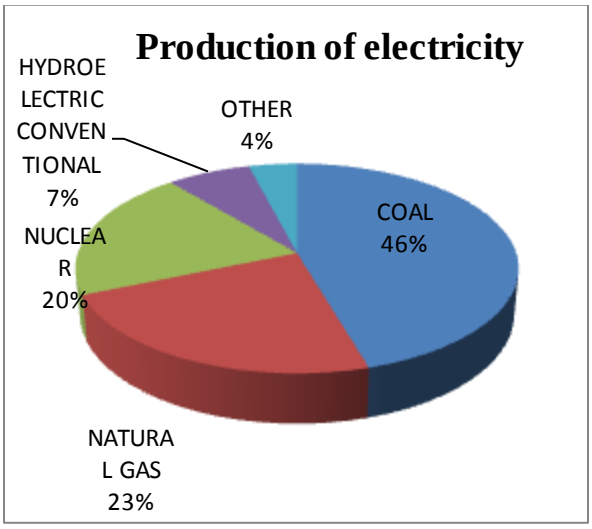
Abstract- **The mechanical load of the current evaporative air cooler is the main cause of consuming high energy. This cause promted us to search for new ways to improve the evaporative air-cooler in terms of energy efficiency, water use efficiency, life, maintenance, and dependence on utility power. As a result, we designed, constructed, and tested a new automated solar powered evaporative cooler that considerably improves on existing designs on all the above mentioned areas. Test results from the modified cooler based on the new design show that it delivered air with noticeably lower temperature than the standard design.**

Index Terms- **Automated Solar Powered Evaporative Air Cooler (ASPEAC), efficiency, solar energy, Temperature.**

1 INTRODUCTION

Solar energy is the light and radiant heat from the sun that influences earth's climate and weather and sustain life. Solar power is sometimes used as a synonym for solar energy or more specifically to refer to electricity generated from solar radiation. Since ancient times, solar energy has been harnessed for human used though arrange of technologies. Solar radiation along with secondary solar resources such as wind and wave power, hydroelectricity and biomass account for most of the available flow of energy on earth.

This paper reveals the comfort conditions achieved by the device for the human body. In summer (hot) and humid conditions feel uncomfortable because of hot weather and heavy humidity so it is necessary to maintain thermal comfort conditions. Thermal comfort is determined by the room's temperature, humidity and air speed. Radiant heat (hot surfaces) or radiant heat



loss (cold surfaces) are also important factors for thermal comfort. Relative humidity (RH) is a measure of the moisture in the air, compared to the potential saturation level. Warmer air can hold more moisture. When you approach 100% humidity, the air moisture condenses these is called the dew point.

2. PRESENT PROBLEM

- The producing of electricity is ultimately responsible for hot and humid conditions i.e. global warming. As in below shown chart it is clear that measure quantity of electricity is produce by coal (fossil fuel).
- Fossil fuels also contain radioactive materials, mainly uranium and thorium, which are released into the atmosphere, which contribute to smog and acid rain, emit carbon dioxide, which may contribute the climate change.
- Longer power cut durations in villages and high cost of cooling products.

3. PROPOSED SOLUTION

The main reasons for high energy consumption are due to mechanical loads in the design of the current evaporative air coolers. This prompted to look for many ways to improve the evaporative air cooler in terms of energy efficiency, lifetime, required maintenance, and tested a new automated solar powered evaporative air cooler unit that considerably improves on existing designs on all these areas. Test results from the new air cooler unit shows that it delivered air with noticeably higher humidity and lower temperature than the standard design. The new unit also saved energy due to the design modifications that were implemented.

4. OBJECTIVE PROJECT

- To make aware of nonconventional energy sources to reduce environmental pollutions.
- To provide solutions for power cut problems in villages.
- To replace existing costlier and high energy consumption cooling methods.

4.1 Solar energy conversion

Solar energy conversion is done by using battery, diode and moisture circuit. As sun light falls on solar panel, which converts into electrical energy by photoelectric effect. This electrical energy stored in battery in the form of chemical energy. Diode is employed in between solar panel and battery which prevents overhanging solar energy conversion process and may protect against overvoltage which can reduce battery performance or life span, and may pose a safety risk. The stored energy directly can use for DC loads or else need to be converted AC (alternate current) by the help of inverter.

5. WORKING MODEL OF THE PROJECT

This concept is driven by solar energy. Component involved in this concept are solar panel, battery, diode, moisture sensors, Evaporative coil, and cooling pads. Solar panel is employed to convert sun light into electrical energy by means of photovoltaic effect. The generated electrical energy is supplied to the battery for storage purpose through charge controller which prevents from power fluctuations. The Motor is surrounded by cooling pads through which continuous water supply is provided. When blower is switch on, Motor sucks atmosphere air into

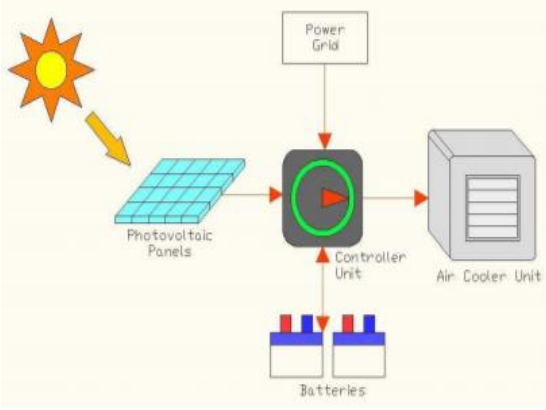


Fig. 11. Photovoltaic solar/grid power system design.

the cabin through the cooling pads, mean time heat transfer occur between water and air, so the cool air enters into the room thus providing required thermal comfort conditions.

Figure 2.shows a schematic diagram of direct evaporative cooling (DEC) system. Wet porous materials or pads provide a large water surface in which the air moisture contact is achieved and the pad is wetted by dripping water onto the upper edge of vertically mounted pads. The evaporated water must be at the same adiabatic saturation temperature of the incoming air. In a DEC, the heat and mass transfer between air and water decreases the air dry bulb temperature (DBT) and increases its humidity, keeping the enthalpy constant(adiabatic cooling) in an ideal process. The minimum temperature that can be reached is the thermodynamic wet –bulb temperature (TWBT) of the incoming air. The effectiveness of this system is defined as the rate of the real decrease of the DBT and the maximum theoretical decrease that the DBT could have if the cooling were 100% and outlet air was saturated.

The cooling pad has a great influence on the overall cooling process of absorption and evaporation of water. Most commonly used cooling pad is made of wood shavings and synthetic fiber and look like grass.

6. RESULT AND DISCUSSION

Experiments were conducted to compare the performance of standard evaporative air-cooler unit to a unit incorporating the above design changes. The

experiments were conducted in college laboratory. The test of new design were started in February,

SR NO	PARTICULAR	RATES (RS)	QTY	COST (RS)
1	Air cooler body with motor	2000	1NOS	2000
2	Soil moisture control ckt	1500	1NOS	1500
3	Dc pump	400	1NOS	400
4	Float control dc pump	400	1NOS	400
5	float	100	1NOS	100
6	Dc supply	150	2 NOS	300
7	Fabrication work charge	2000		2000
	miscellaneous	2000		2000
	TOTAL			8700

2018. New ideas that were brought up during the course of preliminary test of the units were incorporated into the design and tested to refine and improve the unit.

Outdoor site Weather Conditions (Average)	Standard unit (Average)	Modified unit (Average)
Temp. (°C)	Temp.(°C)	Temp.(°C)
29.2	23.4	22.0
28.6	22.4	21.5
31.2	22.6	22.4
32.5	24.3	24.1

Table 1: Cost estimation

7. CONCLUSION

1. Evaporative air cooling system is energy efficient and can be used as an alternative to the conventional system and has a large application potential to provide thermal comfort by cooling and humidification of the ambient air at reduced operating cost.
2. A regulatory push on establishing standards, appropriate cooling pad material and green labeling practices to maximize the use of evaporative air coolers for cooling building spaces is very much essential.
3. Comparing the cost of this product with the existing products in the market is solar product appeals better and affordable by common people. This solar product perfectly suits for villages, schools and offices and thus an alternate to the power cut problems. It comprises of many attractive features such as usage of solar energy, cooler and cooling cabin at lower cost. It is ecofriendly and natural, electricity savers. Durability of the product is more thus minimizing the cost. No electricity is used so this product saves the energy and saves environment from getting polluted.

Comfort thermal conditions achieved in the living room. That is room temperature up to $20.7^{O}C$ and relative humidity of 52%.

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